

# H. ERECTION

1. SURVEYS: CONTRACTOR SHALL EMPLOY A REGISTERED PROFESSIONAL ENGINEER OR PROFESSIONAL SURVEYOR TO BE RESPONSIBLE FOR THE SURVEYING OF THE PROJECT. CONTRACTOR SHALL ORGANIZE STRUCTURAL STEEL SURVEYING PROCEDURES AND RECORDS TO DEMONSTRATE THE DEGREE OF CONFORMANCE OF THE STEELWORK TO TOLERANCES AFFICABLE TO PLANS, LEVEL, HORIZONTAL ALIGNMENT AND ALLOWABLE DISPLACEMENT FROM THEORETICAL POSITION. CONTRACTOR SHALL REPORT ALL DISCREPANCIES. CONTRACTOR SHALL NOT PROCEED WITH EACH ERECTION STEP UNTIL APPROPRIATE CORRECTIONS HAVE BEEN MADE. ON SITE, ACCEPTABLE CORRECTIONS TO THE STRUCTURAL STEELWORK HAVE BEEN ACCEPTED. CONTRACTOR'S SURVEYS FOR STEELWORK SHALL:

- ESTABLISH PERMANENT BENCH MARKS AS SHOWN AND AS NECESSARY FOR THE ACCURATE ERECTION OF STRUCTURAL STEEL;
- ASSURE THAT ELEVATIONS OF BEARING SURFACES, AND LOCATIONS OF ANCHOR DEVICES ARE CHECKED BY ACCURATE SURVEYING BEFORE ERECTION WORK PROCEEDS; AND
- PROVIDE SURVEY DATA DURING THE COURSE OF THE WORK AND A FINAL SURVEY SHOWING THE E-W, N-S AND ELEVATION POSITION OF THE WORK POINTS OF EACH STEEL PLATE, COLUMN AND OTHER MAJOR MEMBER AS COMPARED TO THEORETICAL LOCATION.

d) TAKE SURVEYS AND MEASURE TOLERANCES AND PURSUANCE AT 6 FT (1.8 M) OR SOME CORRECTIONS TO SURVEYS WHERE TEMPERATURE IS EITHER HIGHER OR LOWER.

2. ANCHOR BOLTS AND OTHER CONNECTIONS: FURNISH ANCHOR BOLTS, EMBEDDED PLATES AND OTHER CONNECTION MATERIALS WHICH MUST BE EMBEDDED INTO CONCRETE WORK DELIVER TO THE CONSTRUCTION SITE ON-TIME AND COMPLETE WITH TEMPLATES AND PLACING DRAWINGS. TIGHTEN NUTS IN A MANNER CONSISTENT WITH THE INTENT AND THE MANNER OF THE BOLT MATERIAL.

a) UNLESS OTHERWISE PROVIDED, FOR BOLTS DESIGNATED AS A325, A490 OR DYWIDAG THREADBARS, TIGHTEN 1/4 TURN PAST SNUG TIGHT.

3. BASE PLATES, AND BEARING PLATES: FURNISH AND PLACE BASE PLATES AND BEARING PLATES ACCURATELY, SECURELY SNUG, LEVEL AND ALONG BE RESPONSIBLE FOR MAINTAINING STEEL IN PROPER POSITION THROUGHOUT COMPLETION OF GROUTING AND UNTIL GROUT HAS ACHIEVED FULL STRENGTH. DO NOT ALLOW GROUTING UNTIL BEAMS, COLUMNS AND SO FORTH ARE PERMANENTLY ATTACHED TO CONCRETE.

4. GUYING AND BRACING: THE STRUCTURAL SYSTEM MAY REQUIRE TEMPORARY BRACING IN ADDITION TO MEMBERS SHOWN IN THE CONTRACT DRAWINGS IN ORDER TO RESIST SAFELY ALL IMPOSED LOADS DURING CONSTRUCTION AND TO MAINTAIN CORRECT ALIGNMENT. PROVIDE TEMPORARY GUYING, BRACING AND CONNECTIONS WHERE USED TO RESIST SAFELY ALL POSSIBLE COMBINATIONS OF CONSTRUCTION AND ERECTION LOADS INCLUDING DEAD LOADS, ERECTION LOADS, WIND AND OTHER LATERAL LOADS AND SUPERIMPOSED CONSTRUCTION LOADS, BOTH HORIZONTAL AND VERTICAL. REMOVE TEMPORARY MEMBERS AND CONNECTIONS AFTER PERMANENT MEMBERS ARE IN PLACE. FINAL CONNECTIONS ARE MADE AND CONCRETE HAS ACHIEVED DESIGN STRENGTH.

5. BOLT TENSIONING: ASTM A325 AND A490 BOLTS SHALL BE INSTALLED USING ONE OF THE FOLLOWING SYSTEMS:

a) TENSION CONTROLLED FASTENERS WITH SPLINED TWIST-OFF NUTS (TCF) SHALL BE INSTALLED IN ACCORD WITH ALSO SPECIFICATION REQUIREMENTS AND WITH APPLICABLE PRINTED INSTRUCTIONS AND RECOMMENDATIONS PROVIDED BY THE FASTENER MANUFACTURER AND TENSIONING SYSTEM SUPPLIER. TO PROVIDE UNIFORM AND FULL TENSIONING IN MULTI-BOLT JOINTS, BOLTS SHALL BE TIGHTENED IN STAGES TO ASSURE UNIFORM CONTACT BETWEEN PAYING SURFACES AND SNUG-TIGHT CONDITION AT ALL POINTS WITHIN EACH JOINT PRIOR TO FINAL TENSIONING AND SHEARING OF THE SPLINE.

1) CONTRACTOR SHALL CHECK EACH TCF BOLT AFTER TENSIONING TO VERIFY THAT THE SHEARED SURFACE DOES NOT DISPLAY ANY ABNORMALITY. BOLTS DISPLAYING AN ABNORMALITY SHALL BE REMOVED AND REPLACED.

b) BOLTS ONE INCH (25 MM) IN DIAMETER AND LARGER AND ALL ASTM A490 BOLTS SHALL BE TENSIONED UTILIZING DIRECT-TENSION INDICATING WASHERS (DTI) IN STRICT ACCORD WITH ASTM F959. UNDER NO CIRCUMSTANCE MAY A DTI BE REUSED. DTI WASHERS SHALL NOT BE USED DIRECTLY OVER SLOTTED OR OVERSIZED HOLES BUT SHALL BE USED IN ADDITION TO ALL SPECIAL WASHERS REQUIRED AT SLOTTED OR OVERSIZED HOLES. METHOD, NUMBER, THICKNESS AND TYPE OF WASHERS, PROCEDURE AND MEASUREMENTS SHALL BE IN STRICT ACCORD WITH THE MANUFACTURER'S LATEST PRINTED INSTRUCTIONS AND RECOMMENDATIONS.

1) CONTRACTOR SHALL VERIFY CORRECT TENSION BY MEASURING THE AVERAGE RESIDUAL GAP BETWEEN THE BOLT HEAD OR NUT AND THE DTI IN STRICT ACCORD WITH ASTM F959. TORQUE WRENCHES OR CALIBRATED WRENCHES SHALL NOT BE USED TO INSPECT OR TO VERIFY THE TENSION.

11) FOR BOLTS EXPOSED TO THE WEATHER, GAPS IN TYPE 125 PCT SHALL BE REDUCED TO LESS THAN 0.005 INCHES (0.13 MM) FOR NOT LESS THAN HALF OF THE PERIMETER OF THE DTI. PROVIDE ADDITIONAL GAP REDUCTION WHERE REQUIRED TO PREVENT MOISTURE INTRUSION.

c) FILLER BEAMS MAY, AT CONTRACTOR'S OPTION, BE CONNECTED WITHOUT MAKING USE OF A TENSION CONTROL DEVICE BUT, IF SO, SHALL BE TENSIONED BY THE TURN-OF-THE-NUT TECHNIQUE. FILLER BEAMS DO NOT FRAME TO, OR FRAME IMMEDIATELY ADJACENT TO, COLUMNS, DO NOT FRAME TO GIRDERS CARRYING COLUMNS, POSTS OR WALKERS (EXCEPT STAIR WALKING WALKERS), AND DO NOT FRAME TO TRUSSES.

d) EXCEPT WHERE SPECIFICALLY MAILED IN THE STRUCTURAL DRAWINGS, ALL A325 AND A490 BOLTS, WHETHER OR NOT USED IN BEARING-TYPE CONNECTIONS, SHALL BE FULLY TENSIONED. THIS REQUIREMENT SHALL BE MAINTAINED WHETHER OR NOT REQUIRED BY ALSO SPECIFICATION.

6. BOLTING REQUIREMENTS: CONTRACTOR SHALL PAY STRICT ATTENTION TO THE APPLICABLE CODES AND STANDARDS, TO THE REQUIREMENTS OF THIS SPECIFICATION AND TO THE FOLLOWING GENERAL REQUIREMENTS:

a) IMPACT WRENCHES USED FOR TIGHTENING ASTM A325 AND ASTM A490 BOLTS SHALL BE IN SUFFICIENTLY GOOD REPAIR TO DEFENDABLY DELIVER THE MANUFACTURER'S FULL RATED TORQUE. AIR COMPRESSORS USED TO POWER IMPACT WRENCHES SHALL BE IN GOOD REPAIR AND SHALL BE CAPABLE OF DELIVERING ADEQUATE AIR PRESSURE AND VOLUME SO THAT FULL RATED PERFORMANCE IS ACHIEVED FROM EACH WRENCH AT THE POINT OF BOLTING. AIR HOSES AND COUPLINGS SHALL BE NON-LEAKING. THE IMPACT WRENCHES) SELECTED SHALL TIGHTEN THE BOLTS TO NOT LESS THAN THE MINIMUM SPECIFIED TENSION IN TEN SECONDS OR LESS.

1) FOR BOLT SIZES EQUAL TO OR LARGER THAN 1 IN. (25 MM) A325 AND 1 1/4 IN. (32 MM) A490, PROVIDE IMPACT WRENCHES EQUIVALENT TO OR LARGER IN CAPACITY THAN A CHICAGO PNEUMATIC 6120, WITH AIR PRESSURE AT THE WRENCH NOT LESS THAN 100 PSI (700 KPA).

b) WASHERS: A HARDENED WASHER SHALL BE INSTALLED ADJACENT TO THE BEARING FACE OF THE TURNED ELEVATOR NUT OR BOLT HEAD OF EACH ASTM A325 OR ASTM A490 BOLT ASSEMBLY. A 5/16 INCH (8 MM) THICK WASHER OR THICKER, OTHERWISE CONFORMING TO ASTM F416, SHALL BE USED AT BOTH ENDS OF 1-1/8 INCH (32 MM) DIA. 1-1/2 INCH (38 MM) DIA. STANDARD A490 BOLT. CONNECTING MATERIAL WITH STANDARD 8128 HOLES WHERE MATERIAL IS 5/8 INCH (16 MM) OR LESS IN THICKNESS.

c) LONG SLOTTED HOLES, WHERE ACCEPTED, AND WHERE ON AN OUTSIDE PLY, SHALL BE COVERED COMPLETELY BY 5/16 INCH (8 MM) HARDENED WASHERS; ALTERNATIVELY, EITHER PLATE WASHERS OR CONTINUOUS BARS OF AT LEAST 3/8 INCH (10 MM) THICKNESS AND MINIMUM YIELD POINT OF 50 KSI (345 MPa) MAY BE USED. HOLES IN PLATE WASHERS OR BARS SHALL BE STANDARD SIZE. REGULAR HARDENED WASHERS ARE REQUIRED IN ADDITION TO PLATE WASHERS OR BARS.

d) SHORT SLOTTED AND OVERSIZED HOLES, WHERE ACCEPTED, AND WHERE ON AN OUTSIDE PLY, SHALL BE COVERED BY HARDENED WASHERS, PLATE WASHERS OR CONTINUOUS BARS AS PROVIDED FOR LONG SLOTTED HOLES.

e) BOLTS AND NUTS, AT TIME OF TIGHTENING, SHALL BE CLEAN, RUST-FREE, FREE FROM THREAD DAMAGE, AND SHALL RETAIN NOT LESS THAN THE LIGHT RESIDUAL COATING OF OIL AS RECEIVED FROM THE FACTORY. THREAD LUBRICANTS SHALL BE APPLIED TO ALL ASTM A490 BOLTS OR NUTS, TO ALL 1 IN. (25 MM) AND LARGER ASTM A325 BOLTS AND TO ALL BOLTS AND NUTS THAT DISPLAY ANY SIGN OF LOSS OF RESIDUAL OIL, RUST OR OTHER CONTAMINANT. WHERE GALVANIZED NUTS ARE NOT MAX-DIPPED BY MANUFACTURER, APPLY THREAD LUBRICANT.

1) LUBRICATION SHALL BE COMPLETED PRIOR TO ASSEMBLY AND PRIOR TO BOLTS BEING SET UP INTO THE STEEL FRAME.

11) IN THE EVENT OF A DISPUTE REGARDING TIGHTNESS OF BOLTS INSTALLED IN THE FIELD, CLEANLINESS AND LUBRICATION OF THE BOLT, TENSIONING USED FOR VERIFICATION TESTS SHALL BE SPECIFICALLY REPRESENTATIVE OF FIELD MATERIALS AND CONDITIONS.

f) TIGHTENING PROCEDURES: DURING TIGHTENING, TO THE FULL EXTENT PRACTICAL, THE TURNED BOLT ELEMENT SHALL BE HELD WITHOUT ROTATION. ALL PILES SHALL FIRST BE BROUGHT INTO FULL CONTACT BY PARTIALLY TENSIONING ALL OF THE BOLTS. TENSIONING SHALL COMMENCE FROM THE MOST RIGID PART OF THE CONNECTION, MOVING TO THE FREE EDGES.

g) RETIGHTENING: ASTM A490 BOLTS AND GALVANIZED ASTM A325 AND A490 BOLTS, CASE COMPLETELY OR PARTIALLY TORQUED, SHALL NOT BE REUSED. ASTM A325 BOLTS MAY BE REUSED ONLY WITH SPECIFIC WRITTEN ACCEPTANCE.

h) LENGTH: BOLTS SHALL NOT PROJECT BEYOND THE FACE OF THE NUT BY MORE THAN 0.25 INCHES (6 MM). SMALLER WHERE REQUIRED TO ACHIEVE CLEARANCE.

7. UNPAIR HOLES SHALL NOT BE ENLARGED BY BURNING OR DRIFTING ALONG. ENLARGE HOLES WHERE NECESSARY AND PERMITTED BY PLANS PIERCING OR REINFORCING OR BY REPAIRING DAMAGE OR BY OTHER ACCEPTED MEANS. HOLES AFTER ENLARGEMENT SHALL BE TRUE ROUND HOLES NORMAL TO THE SURFACES JOINED. INCREASE BOLT SIZE TO FILL ENLARGED AND REPAIRED HOLES.

8. SPLICES: COLUMN SPLICES AND OTHER COMPRESSION JOINTS THAT DEPEND UPON CONTACT BEARING AFTER ALIGNMENT SHALL CONFORM WITH THE FOLLOWING:

a) BEARING SURFACES SHALL BE CLEANED BEFORE THE PARTS ARE ASSEMBLED.

b) FASTENING OF COMPRESSION SPLICES AND JOINTS SHALL BE PERFORMED AFTER THE ADJUTING SURFACES HAVE BEEN BROUGHT UNIFORMLY INTO CONTACT.

c) AN AREA OF NOT LESS THAN 65% OF THE CONTACT AREA SHALL BE IN UNIFORM BEARING, WHERE:

1) CONTACT AREA IS THE CROSS AREA OF THE SMALLER PLICE JOINED, WITHOUT DEDUCT FOR WELD BEVELS AND THE LIKE.

11) AREA OF UNIFORM BEARING IS THAT PORTION OF THE CONTACT AREA WHICH IS SEPARATED BY NOT MORE THAN 0.02 INCHES (0.50 MM) FROM THE LARGER PLICE JOINED. NOTE THAT THE TOTAL AREA OF SURFACE JOINED BY WELDING IS LARGER THAN CONTRACTOR'S OPTION, THE AREA OF UNIFORM BEARING MAY BE INCREASED TO CORRECT FIT-UP DEFICIENCIES BY EITHER:

A. INCREASING THE WELD SURFACE AREA; OR

B. PACKING WITH STEELWIRE STEEL SHIMS, 0.02 INCHES (0.50 MM) OR THINNER IN THICKNESS.

d) THE AREA OF UNIFORM BEARING SHALL BE LOCATED SYMMETRICALLY ABOUT BOTH OF THE SYMMETRICAL AXES OF THE SMALLER PLICE JOINED. TO ACHIEVE THIS REQUIREMENT, ANY PART OF THE AREA OF UNIFORM BEARING MAY BE NEGLECTED, PROVIDED THAT THE REMAINING AREA IS NOT LESS THAN 65% OF THE CONTACT AREA.

e) OUTSIDE OF THE AREA OF UNIFORM BEARING, SEPARATIONS GREATER THAN 0.03 INCHES (0.75 MM) SHALL BE CORRECTED BY SHIMMING.

9. FINGER TIGHT: BOLTS DESIGNATED AS "FINGER TIGHT" SHALL BE TENSIONED TO 60 INCH-POUNDS (6 N-M) WITH THE GOALS OF BRINGING THE PARTS FIRMLY TOGETHER WHILE ALLOWING FOR A SLIDING CONNECTION. PROVIDE DOUBLE END OF THE LOCATIONS. PROVIDE NOT LESS THAN TWO FULL CIRCLES OF TORQUING AND UNTORQUING TO ENSURE THAT ALL BOLTS ARE PROPERLY TENSIONED.

10. SHIMS, WHERE REQUIRED TO CORRECT FIT-UP OF WORK, SHALL BE OF STAINLESS STEEL.

11. RIVET AND RIBBON TAPS SHALL BE PROVIDED AT THE ENDS OF ALL SENSITIVE BUT WELDS AND BOTH TAPS AND ERECTION AIDS SHALL BE REMOVED AT ALL LOCATIONS WHERE THEY INTERFERE WITH THE WORK OF OTHER TRADES, AND AT ALL LOCATIONS DESIGNATED. RIVET TAPS SHALL BE NOT LESS THAN 1-1/4 INCHES (30 MM) IN LENGTH.

12. DRILLED-IN ANCHORS SHALL BE INSTALLED IN STRICT ACCORD WITH MANUFACTURER'S PRINTED INSTRUCTION. SET PERPENDICULAR TO CONCRETE SURFACE. ANCHORS MAY BE PLACED IN BLOCK OR BRICK WORK ONLY WHERE Voids WITHIN 9 INCHES (230 MM) OF THE ANCHOR HAVE BEEN FILLED SOLIDLY WITH GROUT. DRILLED HOLES SHALL BE CLEANED THOROUGHLY BY COMPRESSED AIR OR WATER JET. HOLES IN STRUCTURAL STEEL, INTENDED TO FIT OVER DRILLED-IN ANCHORS, SHALL BE 1/16TH INCH (1.59 MM) LARGER THAN THE NOMINAL DIAMETER OF THE BOLT EXCEPT WHERE LARGER OR SMALLER HOLES ARE SPECIFIED IN THE CONTRACT DRAWINGS. PROVIDE STANDARD PLATE WASHER.

13. LOCK NUTS, DOUBLE NUTS OR THREAD LOCKING CHORDON SHALL BE USED ON ALL NUTS NOT TENSIONED IN ACCORD WITH THE SPECIFICATIONS FOR A325 OR A490 BOLTS AND ON ALL A197 BOLTS. PROVIDE THREAD LOCKING CHORDON ON A325 AND A490 BOLTS ONLY WHERE ALLOWED SPECIFICALLY IN THE CONTRACT DRAWINGS; AT OTHER LOCATIONS, USE DOUBLE NUTS OR LOCKING NUTS AS SPECIFIED HEREIN.

H. CLEANING, PAINTING AND GALVANIZING

1. GENERAL: STEEL WORK SHALL BE CLEANED, PAINTED OR GALVANIZED AS PROVIDED HEREIN. BASIC WORK SHALL BE DONE IN THE SHOP, WITH FIELD TOUCH-UP, ONLY, DONE IN THE FIELD.

2. CORROSION PROTECTION: THIS SPECIFICATION CONTEMPLATES 6 LEVELS OF CORROSION PROTECTION:

a) FIREPROOFED/UNPAINTED: STEEL WORK SHALL BE SHOP CLEANED TO MEET THE REQUIREMENTS OF SSPC-SP3. ADDITIONAL CLEANING SHALL BE ACCOMPLISHED IN THE FIELD TO ALLOW PROPER ADHERENCE OF SPRAY FIREPROOFING.

b) FIREPROOFED/SHOP PRIMER: PROVIDE AS FOR FIREPROOFED/UNPAINTED, BUT PAINT WITH SHOP PRIMER WITH FIELD TOUCH-UP, NOT LESS THAN 2.0 NOR MORE THAN 4.0 DRY FILM THICKNESS (50 IN/100 MM). PROVIDE ONLY WHERE SHOWN SPECIFICALLY IN THE CONTRACT DRAWINGS.

c) SHOP PRIMER: PROVIDE AS FOR FIREPROOFED/SHOP PRIMER.

d) EXPOSED TO AMBIENT TEMPERATURE: STEEL WHICH IS ENCLOSED, CONCEALED OR FIREPROOFED, BUT WHICH IS NOT PROTECTED FROM CONDENSED IN AMBIENT TEMPERATURE, SHALL BE CLEANED TO MEET THE REQUIREMENTS OF SSPC-SP3 BEFORE PAINTING WITH A ZINC-RICH PRIMER WITH FIELD TOUCH-UP, NOT LESS THAN 2.0 NOR MORE THAN 3.5 DRY FILM THICKNESS (50 IN/100 MM).

1) PROVIDE GALVANIZED BOLTS, NUTS, WASHERS, DTI'S AND INSERTS, AS APPLICABLE, FOR THE BOLTING OF MEMBERS EXPOSED TO AMBIENT TEMPERATURES.

11) MEMBERS EXPOSED TO AMBIENT TEMPERATURES SHALL BE FULLY PAINTED. NO-PAINT AREAS ARE NOT PERMITTED.

e) EXPOSED TO WEATHER: STEEL WHICH IS EXPOSED TO THE WEATHER INCLUDING EXTERIOR LIGHTS (EXCEPT WHERE STAINLESS IS REQUIRED) SHALL BE HOT-DIPPED GALVANIZED. TOUCH-UP AT WELDS AND AT DAMAGED SURFACES AFTER FIRST CLEANING TO SSPC-SP3, WITH SLAG AND WELD SPATTER REMOVED FROM ALL AREAS. PAINT GALVANIZED STEEL WHERE SHOWN IN THE CONTRACT DRAWINGS.

1) PROVIDE GALVANIZED BOLTS, NUTS, WASHERS, DTI'S, AND INSERTS, AS APPLICABLE, FOR THE BOLTING OF GALVANIZED MEMBERS.

3. PAINT SHALL BE APPLIED ONLY TO DRY SURFACES, ONLY AT TIMES WHEN STEEL SURFACE TEMPERATURES ARE ABOVE THE DEW POINT, AND SHALL BE APPLIED THOROUGHLY AND EVENLY WITHOUT SAGS OR HOLIDAYS. PAINT SHALL BE APPLIED BY SUITABLE SPRAY EQUIPMENT IN STRICT ACCORD WITH THE PAINT MANUFACTURER'S PRINTED INSTRUCTIONS. PROVIDE A DRY FILM THICKNESS WITHIN THE RANGE SPECIFIED HEREIN, INCLUDING AROUND OUTSIDE CORNERS OR OTHER SHARP CHANGES IN SURFACE PROFILE.

4. FIELD TOUCH-UP SHALL BE PROVIDED TO FIELD BOLTS OF PAINTED AND OF GALVANIZED COMPONENTS AND TO ALL POINTS OF DAMAGE, INCLUDING AREAS RECEIVING WELD AFTER COATING.

a) UNPAINTED SURFACES SHALL BE RECLEANED TO THE EXTENT NECESSARY TO ACHIEVE SOUND TIGHT BOND OF OTHER WORK.

b) PAINTED SURFACES SHALL BE CLEANED AND PAINTED TO THE STANDARDS OF THE SHOP COATING AND TOUCH-UP TO AS TO PROVIDE FOR WORK-LIKE SURFACES AND FOR TIGHT BOND OF OTHER WORK.

c) GALVANIZED SURFACES SHALL BE CLEANED OF SLAG AND BURNED METAL BY VIGOROUS WIRE BRUSHING AND OTHER TOOLS, TO PROTECT SHINY METAL, FREE FROM LOOSE PARTICLES. FINISH CLEAN BY SOLVENTS IN ACCORD WITH SSPC-SPL. FIELD-APPLY GALVANIZING TOUCH-UP TO ACHIEVE QUALITY OF THE ORIGINAL AND UNWAGED SHOP COATING.

d) COAT NO-PAINT AREAS AFTER COMPLETION OF ERECTION.

5. CONTACT WITH ALUMINUM: SURFACES WHICH WILL BE IN CONTACT WITH ALUMINUM SHALL RECEIVE TWO COATS OF ALUMINUM PASTE VARNISH OVER A SHOP-PRIMED SURFACE.

## IV. REINFORCED CONCRETE

A. SEE ARCHITECTURAL DRAWINGS FOR EXACT DETAIL AND LOCATION OF CURBS, OPENINGS OR RECESSES IN SLABS AND FOR OTHER DIMENSIONS NOT SHOWN IN STRUCTURAL DRAWINGS.

SEE MECHANICAL AND ELECTRICAL DRAWINGS FOR INFORMATION REGARDING SIZE AND LOCATION OF OPENINGS FOR DUCTS, PIPES, CONDUITS AND THE LIKE, FOR MACHINE PADS, ETC.

OPENINGS OR RECESSES IN THE STRUCTURE WHICH ARE NOT SHOWN IN THE STRUCTURAL DRAWINGS, EITHER DIRECTLY OR BY TYPICAL DETAIL, SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW.

B. NORMAL WEIGHT CONCRETE MIXTURES SHALL BE READY-MIXED CONCRETE 28-DAY COMPRESSIVE STRENGTH,  $f'_c = 4,000$  PSI AND WITH A DRY UNIT WEIGHT OF 145 PCF UNLESS OTHERWISE NOTED. LIGHTWEIGHT CONCRETE MIXTURES SHALL BE READY-MIXED CONCRETE 28-DAY COMPRESSIVE STRENGTH,  $f'_c = 4,000$  PSI. READY-MIXED CONCRETE SHALL BE SUPPLIED BY A NEW YORK CITY CERTIFIED BATCH PLANT.

LIGHTWEIGHT CONCRETE SHALL PROVIDE AN AIR-DRY UNIT WEIGHT OF NOT LESS THAN 110 PCF (1760 KG/CUBIC METER) NOR MORE THAN 115 PCF (1840 KG/CUBIC METER), MEASURED IN ACCORD WITH ASTM C667, AND SHALL HAVE A MAXIMUM FRESH UNIT WEIGHT OF 120 PCF (1870 KG/CUBIC METER). ALL MEASUREMENTS SHALL BE TAKEN AT POINTS OF DISCHARGE INTO THE WORK.

LIGHTWEIGHT COARSE AGGREGATE SHALL BE A ROTARY KILN PRODUCT OF EXPANDED SHALE OR SLATE, CONFORMING TO ANSI/ASTM C330, ASTM GRADE SIZE 167 (19 TO 4.8 MM) OR ASTM GRADE SIZE-68 (9.5 TO 2.4 MM).

HAND-MIXED CONCRETE SHALL BE USED ONLY WHERE SPECIFICALLY ACCEPTED BY ENGINEER. SUCH CONCRETE SHALL BE MIXED ONLY IN WATER-TIGHT CONTAINERS, WITH DRY MATERIALS MEASURED BY LOOSE VOLUME, SAND AND CEMENT MIXED TOGETHER DRY PRIOR TO ADDING COARSE AGGREGATE. WATER, WHEN ADDED, SHALL BE APPLIED SLOWLY WITH THE ENTIRE MASS TURNED TO PROVIDE FOR AN EVEN MIXTURE AT ALL TIMES.

C. UNLESS OTHERWISE NOTED, ALL WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185. ALL REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO ASTM A615, GRADE 60.

D. MINIMUM CONCRETE COVER SHALL BE PROVIDED FOR REINFORCEMENT (SUBJECT TO TOLERANCES PERMITTED BY CODE) IN ACCORDANCE WITH ACI 318, UNLESS OTHERWISE INDICATED.

E. SPLICING OF WWT, AT ALL SPLICED EDGES SHALL BE SUCH THAT THE OVERLAP MEASURED BETWEEN OUTERMOST CROSS WIRES OF EACH FABRIC SHEET IS NOT LESS THAN THE SPACING OF THE CROSS WIRE PLUS 2 INCHES, NOR LESS THAN 8 INCHES.

F. CAST NEW CONCRETE AS REQUIRED TO REPAIR CONCRETE SLABS, BEAM ENCLOSURES, AND THE LIKE THAT HAD BEEN DAMAGED OR REMOVED IN THE EXECUTION OF THIS CONTRACT.

1. FILL WITH NON-SHRINK GROUT ALL ABANDONED SLAB OPENINGS.

G. REINFORCING STEEL DESIGNATED TO REMAIN FOLLOWING THE DEMOLITION AND CONCRETE REMOVAL OPERATIONS SHALL BE REPAIRED IF DAMAGED IN THE COURSE OF THE WORK. SUBMIT REPAIR PROCEDURES FOR ACCEPTANCE BY THE ENGINEER.

H. SPLICING OF REINFORCEMENT IS PERMITTED ONLY AT LOCATIONS SHOWN IN THE CONTRACT DRAWINGS OR AS ACCEPTED BY THE ENGINEER, UNLESS OTHERWISE SHOWN OR NOTED. REINFORCING STEEL SHALL BE SPLICED FOR ITS FULL TENSILE CAPACITY IN ACCORDANCE WITH ACI 318.

I. REINFORCING BAR DEVELOPMENT LENGTHS SHALL BE COMPUTED IN ACCORDANCE WITH ACI 318-89.

J. GROUT UNDER SLAB PLATES AND BEDDING PLATES SHALL BE NON-SHRINKING TYPE.

K. HORIZONTAL CONDUITS ARE PERMITTED IN SLABS PROVIDED THAT THE SLAB THICKNESS IS AT LEAST 4" THICK, THE CONDUIT SIZE IS NOT GREATER THAN 1/3 OF THE SLAB THICKNESS (OR 1/6 OF THE SLAB THICKNESS WHERE TWO CONDUITS MUST CROSS), AND THE CONDUIT IS RUN AT MID DEPTH IN THE SLAB THICKNESS AND ARE SPACED NOT LESS THAN THREE CONDUIT DIAMETERS OR WIDERS OR CAN BE ACCOMMODATED WITHOUT DISPLACING REINFORCEMENT FROM LOCATIONS PROVIDED IN THE CONTRACT DOCUMENTS. ALUMINUM CONDUIT IS PROHIBITED. CONFORM TO THE REQUIREMENTS OF ACI 318.

## V. METAL DECK

A. METAL FLOOR DECK ACTS CONJUGATELY WITH THE CONCRETE. PROVIDE GALVANIZED STEEL FLOOR AND ROOF DECK CONFORMING TO ASTM A551 SQ GRADE 40, HAVING A MINIMUM YIELD POINT OF 40 KSI. GALVANIZING SHALL CONFORM TO ASTM A924, MINIMUM COATING OF 0.01 INCHES (0.25 MM) OF ZINC. FOR INSTALLATION OVER BITS TO BE ENCLOSED UNDER WATERPROOF DECKS AND AT ROOFING LEVELS, USE COATING 0.02 OR HEAVIER. PROVIDE UNITED STEEL DECK, 20 GAUGE (MIN), 2" DEEP LOR-FLOOR DECK AND UNITED STEEL DECK, 18 GAUGE (MIN), 1 1/2" DEEP TYPE B1 ROOF DECK.

B. SHEET METAL ACCESSORIES: CONFORM TO ASTM A526, COMMERCIAL QUALITY, GALVANIZED.

C. WELDING MATERIALS SHALL CONFORM TO BUILDING CODE AND TO AWS A5.1 OR A5.5, AND SHALL BE E7010G FOR JOINING STEEL DECK TO STRUCTURAL STEEL AND FOR WELDING STEEL DECK SIDE LAPS; E7018 FOR JOINING STEEL PLATES AND SHAPES.

D. SELF-DRILLING FASTENERS FOR DECK SIDE LAPS: #12-14 X 3/4" HXN TEXS/1 AS MANUFACTURED BY BULLDOX DIVISION OF ILLINOIS TOOL WORKS, ELK GROVE VILLAGE, ILLINOIS, OR OTHER ACCEPTED BY ENGINEER.

E. INSTALL STEEL DECK UNITS AND ACCESSORIES IN ACCORD WITH MANUFACTURER'S RECOMMENDATIONS, ACCEPTED SHOP DRAWINGS, AND AS SPECIFIED HEREIN.

F. CLEANING: PRIOR TO LAYING OUT STEEL DECK UNITS, CONTRACTOR SHALL CLEAN SURFACE OF SUPPORTING STEEL, REMOVING GREASE, OIL, DEBRIS AND OTHER DELTERIOUS FOREIGN MATERIAL WHICH MAY INTERFERE WITH THE CONSISTENT ACHIEVEMENT OF SOUND WELDING OF STUD SHEAR CONNECTORS THROUGH STEEL DECK AND OF ARC WELDING OF DECK UNITS TO SUPPORTS.

G. FASTENING: PERMANENTLY FASTEN STEEL DECK UNITS TO SUPPORTING MEMBER BY 0.75 INCH (20 MM) DIAMETER FUSION WELDS AT 12 INCHES (300 MM) MAXIMUM SPACING UNLESS A SMALLER SPACING IS GIVEN IN THE CONTRACT DRAWINGS OR OTHERWISE REQUIRED BY THE PROVISIONS OF THIS SPECIFICATION. WELDS MAY BE OMITTED IN KIDS IN WHICH SHEAR CONNECTORS ARE TO BE APPLIED EXCEPT THAT EACH DECK SECTION SHALL HAVE SUFFICIENT WELDS TO ADEQUATELY SECURE THE DECK AND TO BRING THE DECK INTO DIRECT CONTACT WITH THE SUPPORTING STEEL.

H. SIDE LAPS: LOCK SIDE LAPS BETWEEN ADJACENT DECK UNITS BY 12 INCHES (300 MM) MAXIMUM SPACING UNLESS A SMALLER SPACING IS GIVEN IN THE CONTRACT DRAWINGS OR OTHERWISE REQUIRED BY THE PROVISIONS OF THIS SPECIFICATION. WELDS MAY BE OMITTED IN KIDS IN WHICH SHEAR CONNECTORS ARE TO BE APPLIED EXCEPT THAT EACH DECK SECTION SHALL HAVE SUFFICIENT WELDS TO ADEQUATELY SECURE THE DECK AND TO BRING THE DECK INTO DIRECT CONTACT WITH THE SUPPORTING STEEL.

I. AT CANTILEVER SPANS, SIDE LAP LOCKS SHALL BE PLACED NOT MORE THAN 3 INCHES (75 MM) FROM DECK END AND AT INTERVALS NOT EXCEEDING ONE-HALF OF NORMAL SPACING.

J. OPENINGS THROUGH SLAB/DECK OR DECK WHICH ARE NOT SHOWN IN THE STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO ENGINEER FOR REVIEW.

## VI. CONTROLLED INSPECTION

A. CONTROLLED INSPECTION IS REQUIRED PER NYC BUILDING CODE C27-132 FOR ALL STRUCTURAL STEEL WELDING, HIGH STRENGTH BOLTING, INSTALLATION OF CONCRETE REINFORCING STEEL, AND CONCRETE PLACEMENT OPERATIONS.



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REGISTERED PROFESSIONAL ENGINEER  
No. 125642000 Exp. 06/30/2008

**LESLIE E ROBERTSON**  
ASSOCIATES, P.L.L.C.  
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I HEREBY CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF ONE OF THE CONTRACT DRAWINGS CONSTITUTING A PART OF CONTRACT NO. **WTC-945.071** IN THE FORM IN WHICH SAID DRAWINGS WERE SUBMITTED AT THE TIME THE SAID CONTRACT WAS EXECUTED BY THE PARTIES.

DATE **1/16/98** **Sullivan A. Adams**  
SPEC. WITNESS

DATE **4/10/98** **P.L. Leven**  
ENGINEER OF DESIGN

No.	Date	Revision	Approved
1	11/7/97	ISSUED FOR BID	

Engineering Department  
Design Divisions

**The World Trade Center**

STANDBY POWER  
5 WORLD TRADE CENTER

STRUCTURAL

GENERAL NOTES

This drawing subject to conditions in contract. All inventions, ideas, designs and methods herein are reserved to Port Authority and may not be used without its written consent.

M/S CU RZ  
Designed by Drawn by Checked by

Date 11/17/97 Scale

Contract Number WTC-945.071 Drawing Number SO-04

